

ASSESSMENT OF THE EFFECTIVENESS OF METHODS USED IN THE TEACHING AND LEARNING OF MATHEMATICS IN NAROK NORTH SUB COUNTY

Mary M. Ng'ethe, Maryconsolata Shinali

School of Education, Maasai Mara University, Narok,
KENYA.

Ngethemary28@gmail.com, maryshinali@gmail.com

ABSTRACT

The purpose of this study was to assess the effectiveness of techniques used in the teaching and learning of mathematics in Narok North Sub County. Many teaching and learning techniques have been adopted by different pre-schools in Narok North Sub County. This study was carried out to: describe the techniques used by teachers of mathematics in selected pre-schools and assess the effectiveness of the techniques used by the teachers in the teaching of mathematics. The study was based on Piaget's cognitive development theory. The central concern of this theory is the relationship between child cognitive development and teaching of concepts. The study adopted descriptive survey design. The study focused on both private and public pre-schools. Systematic random sampling was used to select 15 out of 54 pre-schools. The study collected data using observation schedules and questionnaires. The data collected was analyzed qualitatively and quantitatively with the help of SPSS version 20 through the use of numbers, descriptive statistics and was presented in frequency tables, percentages, and pie-charts. The findings of this study will be useful to policy makers in identifying areas of concern in Early Childhood Education and address them in the best interest of the child. It also will assist curriculum developers to identify the loopholes that are present in the teaching of Mathematics and finally it also will assist pre-school teachers to come up with the best methods that are suitable to be used in teaching pre-school children in the county.

Keywords: Techniques, Early Childhood Education, pre-unit, pre-school

INTRODUCTION

Education is an important vehicle for development in the world. There is no nation which can develop when her citizens do not have the right and effective education. Education is an effective weapon to fight the war against poverty, disease and ignorance, which are the root cause of many of the world's problems.

In Kenya, following the introduction of the free primary education programme in 2003, enrolment increased by over 1 million pupils or by 17.6 per cent. However, information from recent research studies, suggests that this high increase in enrolment has not been matched by increase in learning. [16] UWEZO (2010), reports that almost half of Standard 4 pupils cannot read a Standard 2 level story and that a third of the pupils in Standard 2 cannot read some simple words while only a third can read a paragraph of their level.

The UWEZO assessment report also indicates that only half of the children in Standard 1-8 aged 6-16 years have acquired the highest numeracy competency expected of Standard 2 learners. Similarly, the Kenya National Examinations Council's (KNEC) assessment of Standard 3 learners in numeracy and literacy reported poor learning achievement. The report indicates that mean achievement in reading was (297.58) while mean achievement in numeracy was (295.6) that is below the average mean of 300 [7] (KNEC, 2010).

The development of Mathematics as a subject in the school curriculum is part of the mainstream changes that derived impetus from the early beginnings of systematic curriculum planning in Kenya. Mathematics was one of the later subjects to be affected by this wind of change in both methodology of teaching and in the content making up the disciplines. During this period, new methodologies in the teaching of Mathematics were developed. In addition to this, new mathematical concepts were created [6] (Granstom, K. 2006).

[12]Orton and Frobisher (1996) stated that Mathematics should be regarded as one of the most important subjects in the school curriculum. Mathematics as an organized body of knowledge, where ideas, principles and concepts involving numbers are built up logically. There are several aspects to be considered for determining a learner's performance in a mathematical context. These include the attitude of the mathematics instructor, the teaching methods employed, the content of the syllabus, and the attitude of the parents. All these aspects influence a learners' attitude towards mathematics and so, consequently, mathematics performance [17] (Weddy & Catherine, 1992)

Most pupils regard mathematics as the most difficult and unpleasant subject in the school's curriculum, and yet are forced to study it. Teaching in pre-school should remain at the center of providing early mathematics education as pre-school education becomes formal. After much effort under the present system, some pupils master a few of the basic concepts and learn to use them, and eventually the more able of them manage to pass the examination. It is important, therefore, that changes are made so that mathematics education can become more meaningful and profitable to children. Since there is a close relationship between teaching methods and a pupil's performance, the methods used in teaching mathematics are important to ensure that a learner will understand what is being taught [1] (Cobb, P. 1998).

Many factors contribute to unequal participation and performance in mathematics including different pre-schools techniques of teaching, learning and curriculum emphasis. [8] Moomaw,S. (2011) asserted that pre-school programmes had been shown to produce measurable, very long-term changes in the intelligence quotient of children receiving education from such programmes. [5]Goffin & Wilson (2001), believed that for children to succeed in school it will be greatly influenced by their early educational experiences. Children, who developed an interest in learning, before they entered primary school, are more likely to do well in school than those who have not developed such an interest.

Consequently, pre-school education is the ultimate foundation stone needed by the child to smoothly transit to the formal school system of primary level. Any shaky foundation naturally will affect other levels.

Statement of the Problem

The essence of supporting literacy in early childhood setting is widely accepted, although very little attention is given to mathematics. Childrens' capacity to learn mathematics and also with evidence that early success in mathematics is linked to later success in both mathematics and reading makes it clear that basic literacy consists of both reading and mathematics.

Learners, who are introduced to mathematics concepts earlier, later develop better competencies in mathematics. The increasing importance of science and technology in everyday life and for success in many careers highlights the need for a strong foundation in mathematics. Many parents want their children to succeed in the subject [12] (Orton and Frobisher, 1996).

Many teaching and learning techniques have been adopted by different pre-schools. The use of different teaching and learning techniques in various pre-school, has given rise to

discrepancies in the performance of mathematics. These techniques are dependent on individual pre-school. This study therefore was to assess the effectiveness of techniques used in the teaching and learning of mathematics in Narok North Sub County.

Purpose of the study

The purpose of the study was to assess effectiveness of techniques used in the teaching and learning of mathematics in Narok North Sub County.

Research objectives

The objectives of the study were;

1. To describe the techniques used by teachers in the teaching of mathematics in pre-schools.
2. To assess the effectiveness of the techniques used by the pre-school teachers in the teaching of mathematics.

Significance of the study

The findings of this study will be useful to pre-school teachers, policy makers, curriculum developers and other pre-school stakeholders. These findings will be useful to policymakers in identifying areas of concern in Early Childhood Education and address them in the best interest of the child. It will also assist curriculum developers to identify the loopholes that are present in the preschool models in teaching Mathematics and finally it will assist pre-school teachers to come up with the best "techniques" that are suitable to be used in teaching pre-school children in the country.

Scope of the study

The study described the teaching and learning techniques and assessed the effectiveness in the teaching of mathematics. In the study 15 pre-schools attached to public primary schools in Narok North Sub County were sampled for the study. In total 15 teachers of mathematics took part in the study.

Limitation(s) of the study

The current study assessed the effectiveness of different techniques used in the teaching and learning of mathematics. However generalization of findings could be done in other subjects with a lot of caution since the study only dealt with mathematics performance in Narok North Sub County.

Assumptions of the Study

1. Pupils performed differently on the basis of the different techniques used in their school
2. They are different teaching and learning techniques that exist in the zone.
3. That the respondents were to be honest and cooperative in providing the required information to facilitate the study.

Theoretical Framework

The study was based on cognitive development theory, also known as developmental stage theory by [13]Piaget (1950). The central concern of this theory is the relationship between child cognitive development and teaching/learning of concepts. He postulates that, children progress through a series of four key stages of cognitive development marked by shifts in how they understand the world. Piaget believed that children are like "little scientists" and that they actively try to explore and make sense of the world around them.

Children construct an understanding of the world around them, then experience discrepancies between what they already know and what they discover in their environment. Children need to move forward in their abilities to think logically.

This study aims at improving the standard of teaching and learning mathematical concepts which is of great concern to educators and policymakers in ECD. [13] Piaget (1950) as quoted by [9] Mutunga and Breakell (1992), indicates that early experiences have an effect on young children and providing them with learning opportunities based on discovery is likely to result in increased achievement in mathematics skills at this critical period in their lives. Therefore, cognitive development theory was ideal in this study on the assessment of the effectiveness of different techniques used in the teaching and learning of mathematics as children learn progressively in stages based on their ages.

When teachers use the various "pre-school techniques" to teach, the learners are exposed to different methodologies and learning materials in their classes. This situation in turn will definitely affect their learning of mathematics concepts and hence their performance in the subject as Piaget observed that the ability to perform mathematical operation indicates a level of skill, concept mastery and readiness to learn more advanced mathematical operations. Therefore, teachers who work with children in both the pre- operational and concrete operational level of cognitive development should adopt suitable "pre-school techniques" in teaching of mathematics concepts in Early Childhood Education.

In his research in childrens' cognitive development, Piaget noted that children think in terms of the concrete world. Children who are of the same grade and of the same age perform differently on tasks measuring basic addition and subtraction fluency. Moreover, children in the pre-operational and those children in the concrete operational levels of cognitive development perform combined arithmetic operations (such as addition and subtraction) with similar accuracy, children in the concrete operational level of cognitive development have been able to perform both addition problems and subtraction problems with overall greater fluency.

This study aims at improving the standard of teaching and learning mathematical concepts which is of great concern to educators and policymakers in ECD. [13] Piaget (1950) as quoted by [9] Mutunga and Breakell (1992), indicates that early experiences have an effect on young children and providing them with learning opportunities based on discovery is likely to result in increased achievement in mathematics skills at this critical period in their lives. Therefore, cognitive development theory was ideal in this study on the assessment of the effectiveness of different techniques used in the teaching and learning of mathematics as children learn progressively in stages based on their ages.

LITERATURE REVIEW

Teaching of mathematics in pre-school

Policy makers at the state and local levels recognize the importance role preschool education in children's learning and development. However, they may have less understanding of what constitutes an effective and quality preschool program. Consequently, the multitude of available teaching techniques, the confusion regarding which ones are appropriate for 3- and 4-year-olds is understandable [13] (UNESCO, 2001). However, if one of the major goals of preschool is to improve children's school success by enhancing their early skills and knowledge, programs serving preschoolers need to decide the content of what children should learn, as well as how they will best learn it.

The use of resources involves the use of more than one of the human senses, during the learning process. [19] The World Bank Development Report (Young, M.E, 1996) in

investigating education included having educational systems working towards maximum efficiency in the use of available resources to improve the quality of education.

Consequently, there is a need for visual teaching aids and for active participation in lessons by pre-school children. The definition of instructional methods refers to a broad set of teaching methods, practices, techniques, procedures, routines and rules used by teachers in an attempt to facilitate learning [4] (Duncan, 2007). This should involve the selection and arrangement of the elements of the curriculum, and the various ways in which they are introduced to the pupils. Educators, researchers and scholars have consistently challenged methodology on mathematics in Kenyan schools.

[4] Duncan, G.J, (2007) criticized teachers for using out-dated approaches to teaching. He recommended the application of productive methods of teaching as opposed to learning by rote (repeating words but not understanding the meaning). The methods used should not ignore learner-based activities and participation. The Education Commission (1964) challenged teachers of academic subjects, including mathematics, to take full advantage of practical activities, such as the making of models to illustrate the concepts they taught. [8]Moomaw (2011) indicated that new teaching methods should move in a continuous way, from the old teaching methods of the expository kind to the new child-centred method. To achieve this, mathematics teachers should use such techniques as the lecture, the discussion of mathematical concepts, group work (to aid understanding of manipulating numbers), text book reading, games involving numbers and slides. The aim is to improve numeracy (the ability to use numbers in arithmetical calculations).

Effectiveness of the teaching methods in mathematics

The mathematical interests and knowledge young children bring to school may indeed differ, but the causes are more likely to be their varying experiences, rather than their biological endowment. While teachers should be aware of and sensitive to these differences, they should never lose sight of the fact that all children, regardless of their backgrounds and prior experiences, have the potential to learn mathematics. In fact, the gaps in early mathematics knowledge can be narrowed or even closed by good mathematics curricula and teaching method [2] (Clements & Sarama, 2007b; Griffin, 2007a; Klein & Starkey, 2002; Sophian, 2004).

Throughout the early years of life, children notice and explore mathematical dimensions of their world. They compare quantities, find patterns, navigate in space, and grapple with real problems such as balancing a tall block building or sharing a bowl of crackers fairly with a playmate. Mathematics helps children make sense of their world outside of school and helps them construct a solid foundation for success in school. In primary school and pre-school, children need mathematical understanding and skills not only in mathematics courses but also in science, social studies, and other subjects [2] (Clements, D.H 2001).

For learning in general, [6] Granstrom (2006) shows that different teaching method in classrooms influence the outcomes for learners in different ways. Settings where learners are allowed and encouraged to cooperate with classmates and teachers give the learners more opportunities to understand and succeed

A research that was conducted showed that learners who had been using textbooks performed well in similar textbook situations. However, these students experienced difficulties in using mathematics in open, applied or discussion-based situations. The students who had learned mathematics through group-based projects were more able to apply their knowledge in a range of situations. Boaler's research gives evidence for the theory that context constructs the knowledge that is produced.

On the other hand, negative relationships have also been found between teachers who spend a high proportion of time communicating with learners individually and learners' achievement [11] (Mortimer, 1988; OfSTED, 1996). Learners' mathematics performances were low when they practiced too much repetitive number work individually [11] (OfSTED, 1996). A traditional direct-instruction/active teaching model seems to be more effective than a teaching method that focuses on independent work.

RESEARCH METHODOLOGY

Research Design

This study adopted descriptive/ survey design. It enabled the researcher to assess the effectiveness of pre-school techniques used in the teaching and learning of mathematics and to explain the relationship between variables. The study applied descriptive designs to gather data, since it accurately portrays the profile observed in the pre-school learners' performance

Location of the study

The study was carried out in Narok North Sub County, in the South Rift of Kenya. The sub county was sampled because there are several pre-schools centres operated by several organizations and the teachers follow different pre-school teaching techniques.

Target population

Narok North Sub County made up of 54 Pre-schools both private and public, with a total population of 8100 pupils and 324 teachers. Each pre-school has an average of 150 pupils and an average of 6 teachers per pre-school.

Sampling and sample size

A systematic stratified proportional sample was obtained from the list of pre-schools both private and public in Narok North Sub County.

Data Collection Instruments

The researcher used two tools to collect the data; teacher questionnaire and observation schedule.

Teacher Questionnaire

Teacher questionnaire was used to collect data from the teachers based on the techniques they use in the teaching of mathematics in their pre-schools.

Observation Schedule

The teachers' observation schedule consisted of two sections. In section A was to obtain details of the school, class enrolment and teachers gender. Section B section was for the purpose of obtaining different techniques used in the teaching and learning of Mathematics in classroom setting.

Validity

To ascertain the internal validity of the instrument the researcher consulted course experts in the department of Education of Maasai Mara University to validate the research instruments, that is, the teachers' questionnaire and observation schedule.

Reliability

In order to ascertain the reliability of the instruments, the researcher carried out a split-half test by administering the questionnaire to two different groups. This was done twice within an interval of two weeks from each other. Results of these two studies were then analyzed

and measured using Pearson Product Moment of Correlation. The results yielded a correlation coefficient of between 0.65-0.85, and therefore, it was acceptable, [3]Cohen and Manion (1992).

Data Analysis and Presentations

Results from closed ended items in the questionnaire were coded and analyzed quantitatively in form of whole numbers and converted into percentages with the help of Statistical Package for Social Science (SPSS) version 20.

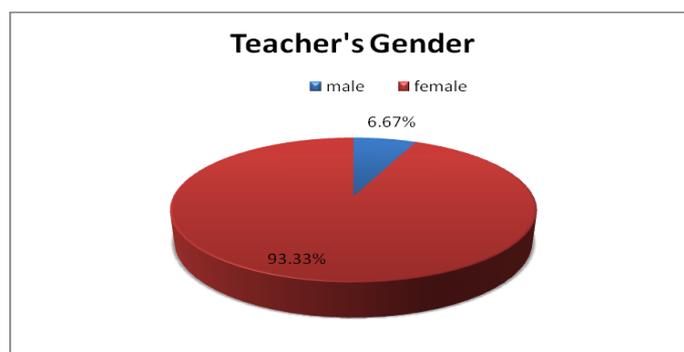
RESULTS AND DISCUSSION OF THE STUDY

Report on Teacher Questionnaire

The researcher got responses from 14 of these respondents and this represented an average response rate of 99%. One teacher did not respond (that indicated 3.3% less in the category).

Teacher's Gender

The majority of teachers was in the age bracket of 26-35 years (60%), followed by those in the age bracket of 25years and below at 33.33%, whilst those in the age bracket of 36-45 were only 6.67%.



Teachers' Academic Qualification

The researcher wanted to know the academic, as well as professional, qualifications of the teachers. The majority of the respondents had KCSE or KCPE being 60% and 33.33% respectively. Those with KJSE were 6.67%. On their professional qualification, the majority of the respondents (53.33%) are untrained, 20% had a ECDE Certificate, 6.67% Montessori Certificate 6.67% KHA Certificate respectively and 13.33% ECDE Diploma.

Techniques used in teaching and enhancing Acquisition of Skills and Concepts in Mathematics.

The results are summarized below.

Effectiveness of teaching methods in pre-school

Effective instruction depends on identifying the knowledge children already possess and building on that knowledge to help them take the next developmental step. Developmental progressions can help identify the next step by providing teachers with a road map for developmentally appropriate instruction for learning different skills. Similarly, when a child is unable to grasp a concept, developmental pre-requisites can inform a teacher what skills a child needs to work on to move forward.

Mathematics Games and Play

Even those who said that they are given, they couldn't give examples of the games and plays they were given by their teachers. Games and sports would provide a natural and automatic avenue for voluntary learning in children. This would make learning fun and hence not only enticing but also interesting to them. This provides a golden opportunity for them to learn at the best of their interest. This can best be initiated by teachers as well as the caregivers, something that can be possible only if they are not only doing it to stimulate the learners but also having positive attitude towards mathematics this agrees with [4] Duncan G.J, (2007).

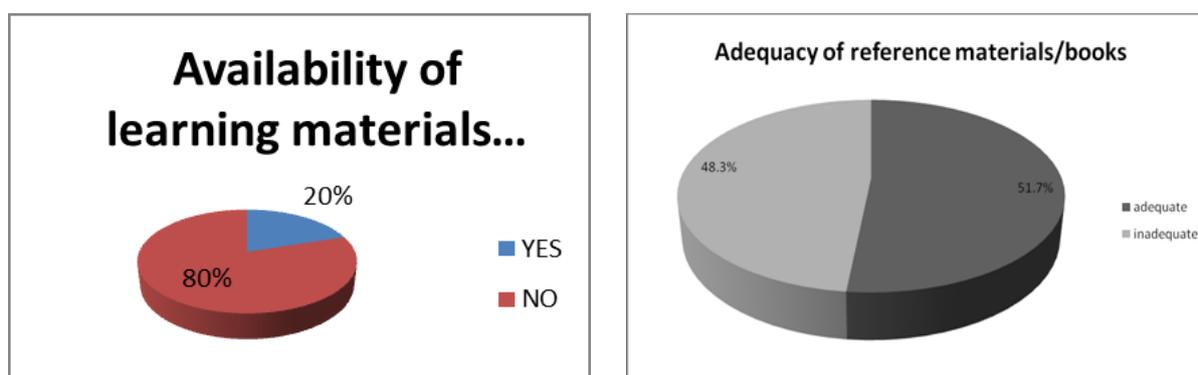
Availability of teaching/learning materials

The researcher made some observations in the respondents' classrooms to establish availability of learning materials.

Adequacy of reference materials

The researcher sought to know whether the teachers thought whether there were enough reference materials for mathematics. On this, there was no clear cut indication whether they felt there is or no adequate reference materials for mathematics in class. Those who indicated there are adequate reference materials were 51.7% followed closely by those who indicated there are no adequate reference materials. The results are presented in the graph below.

Figure 2: Adequacy of Reference Materials /Books



The researcher observed that teachers used several techniques in teaching of mathematics, there was no clear cut of the model used while teaching since there was overlapping of several pupil's and teacher's activities which suggested different model at the same time. Children are seen intensely engaged in play. Pursuing their own purposes, they tend to tackle problems that are challenging enough to be engrossing yet not totally beyond their capacities.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

1. The study established that most children indicated a preference for a woman teacher, probably because most pre-school teachers are women.
2. The researcher established that lack of ECDE professionalism and practice of teaching may have affected the performance of the children in mathematics.
3. The study established that there was no single pre-school that adhered to a specific mathematics teaching and learning technique, knowing or unknowingly teachers chose to

overlap their curriculum by incorporating different elements from various pre-school teaching methods from the models.

4. On mathematics reference materials and books, the response was largely that they were inadequate, with the result that teachers had to improvise with varying degrees of success, but showing the desire of the teachers to do the best for their pupils.
5. The majority of children indicated that they were not given mathematics games as a means of improving their understanding of mathematical concepts.

Conclusion

1. At some point, it's good to incorporate some male teachers for affirmative action. This will give a chance for children to get some role models, especially boy child.
2. Teachers should be equipped with ECDE methodology of teaching to help them develop a deep understanding of the mathematics they will teach and the habits of mind of a mathematical thinker.
3. Lack of reference materials therefore could be one of the main causes for poor performance in mathematics.
4. Lack of mathematical games and plays, could mean that the motivation that these children needed while learning is lacking, and so could have resulted in their continuing poor performance in mathematics. A child when at play can learn a great deal about various aspects of life, and games are an opportunity for them to learn mathematical concepts. Sadly, this is not the case at present in Narok North Sub County.

Recommendations

1. To avoid discontinuity this study recommends that in pre-school male and female teachers should alternate to make the learners get used to male teachers.
2. Paid study leave/time should be provided so that the existing workforce does have the necessary knowledge to teach effectively.
3. Effective teaching and learning techniques should also include intentionally organized learning experiences that build children's understanding over time.

This study further recommends that guidance should be issued on how children may be given mathematics plays.

Finally, the learning techniques in pre-school level should be prepared with the stages of child development in mind and opportunities where children can improve in mathematics may be utilized.

REFERENCES

- [1] Clements, D. H. (2001). *Mathematics in the preschool: Teaching children mathematics*. USA: Author.
- [2] Cobb, P. (1998). *Analyzing the mathematical learning of classroom community*. South Africa: The University of Stellenbosch.
- [3] Cohen, I., & Manion, L. (1992). *Research methods in education (3rd Ed.)*. New York: Routledge.
- [4] Duncan, G. J. (2007). Why Mathematics? *Journal of Developmental Psychology*, 43(428).
- [5] Goffin, S.G., & Wilson, C. (2001). *Curriculum models and early childhood education: Appraising the relationship (2nd Ed)*. Upper Saddle River, NJ: Prentice Hall.
- [6] Moomaw, S. (2011). *Teaching mathematics in early childhood*. Balti-more: Brookes Publishing Company.
- [7] Mutunga, P., & Breakell, J. (1992). *Mathematics education*. Nairobi, Kenya: Educational
- [8] NAEYC & NCTM. (2002). *Early childhood mathematics: Promoting good beginnings*.
- [9] OfSTED. (1996). *Successful teaching of literacy and numeracy in primary schools: A starting*
- [10] Orton, A., & Frobisher, L. (1996). *Insight into teaching mathematics*. New York: Author.
- [11] Piaget, J. (1929). *The child's conception of the world*. New York: Harcourt.
- [12] *point: For the 1996 GEST proposals*. London: OfSTED.
- [13] Sarama, J., & Clements, D. H. (2009). *Early childhood mathematics education research: Learning trajectories for young children*. New York: Routledge.
- [14] UNESCO, IIEP. (2001). *The quality of education: Some policy suggestions based on a survey of schools*. Paris: UNESCO.
- [15] UWEZO. (2010). *Are out children learning*. Nairobi, Kenya: UWEZO.
- [16] Wallen, N.E., & Fraenkel, J.R. (2010). *How to design and evaluate research in education*. New York: McGraw-Hill Companies Inc.
- [17] Weddy, S., & Katherine, H. (1992). *Equal Mathematics education for female students*. USA: Newton Educational Development Centre.
- [18] Young, M.E. (1996). *Proceedings of a World Bank conference on early childhood development*. USA: World Bank